Professor H. A. Newton, in discussing the "Relation of the Orbits of Meteorites to the Earth's Orbit," found that, from 116 observed meteoritic falls, 109 of them must have been following the Earth, while only seven met it. In further summing up his deductions he says that "nearly all the stones in the solar system are moving in direct orbits, very few in parabolic orbits, unless we can assume that stones moving in retrograde orbits for some reason—as, for example, their great relative velocity—may not have been able to pass through the air and to reach the ground in a solid form." He also concludes that the "larger meteorites are allied much more closely with the group of comets of short period than with the comets whose orbits are nearly parabolic" (*American Journal of Science*, 1888 July). This appears to be in agreement with the general directions of ordinary fireballs, which are somewhat rarely heard to detonate, and more rarely still seen to precipitate stones to the ground. But the silent fireballs may not be essentially different either in origin or character from the aerolites which have actually fallen. The observed varieties of appearance may have been introduced by differences in distance, in size, velocity, and condition as affecting their capacity to withstand disruption and dissipation from the heat generated by their violent impact with our atmosphere. Marked differences have been noticed in the composition of meteorites, as everyone knows, and these have led to their classification as Aerolites, Siderites, and Siderolites; but there is also a remarkable diversity in the character of certain terrestrial stones. The opinion has thus been gaining ground in late years that we may take the whole of meteoric objects as displaying a community of origin, the apparent departures from uniformity being due to the vicissitudes these bodies have to encounter in planetary space, to the variable conditions under which they individually become visible, and to the destructive reception they instantly meet with on rushing into the air.

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The Discovery of Comets. By W. F. Denning.

Observers before devoting themselves to any particular line of work naturally consider the prospects offered and the amount of labour likely to be expended in ensuring reasonable success. Comet-seeking is generally regarded with dubious feelings, for though the observer may be attracted by the chance of effecting a discovery, he nevertheless hesitates before entering upon a research essentially requiring patience and perseverance in an

extreme degree. The tedious * work of sweeping the sky must be carried on with habit and system for a comparatively long period, though possibly no result whatever may accrue. Moreover, a difficulty which offers a serious impediment to observation has to be encountered in the vast numbers of nebulæ crowding the firmament. These objects are the bane of the comet-seeker, for the necessity of identifying many of them occupies considerable time; and occasionally they become a source of error, for scores of instances might be quoted where nebulæ have been mistaken for comets and actually announced as such.

The idea has sometimes occurred to me that it would be very interesting to learn from habitual and successful observers in this field what is the average number of hours expended in the discovery of a comet. I do not remember to have seen any such information, though it would undoubtedly be valuable as a guide. It is questionable whether the chief living comet-finders, such as Winnecke, Coggia, Borrelly, Swift, Barnard, and Brooks, have ever recorded the data necessary to afford instruction on the point referred to, but if they have preserved any material of the kind it is to be hoped it will be published. My own work in this department at Bristol has not been sufficiently extensive to furnish a trustworthy deduction, but it may be mentioned that five new comets † have been discovered as the outcome of 596 hours of sweeping. This is equivalent to one comet for every 119 hours of work. To put the matter another way: if an observer (under conditions precisely similar to my own) seeks for comets during two hours on each of sixty fine and moonless nights, he may expect to find one. If the search is prolonged each night for four hours, then the number of nights required for a discovery would be thirty, and so on. It should be stated that my figures are based on observations conducted with a 10-inch reflector, having comet eyepieces with powers of 32, 40, and 60, and fields of 72′, 65′, and 55′. I have generally used the power of 40, field 65′.

The average above stated would certainly not apply to everyone, for much depends upon the skill of the observer, upon the quality of the instrument used, and upon the place of observation. Different individuals would yield averages according to their capacity and to the circumstances under which they carried on the pursuit.‡ In a finer climate than that of England a man

* The work is, however, very rarely regarded as tedious by anyone prompted by genuine love for the subject. At times, it is true, in very cold weather, or when the observer's health is indifferent, an effort is required to continue it.

† One of these comets was discovered at the Lick Observatory on the evening preceding its detection at Bristol, but as my discovery was a perfectly independent one, I have thought it fair to include it in the total.

‡ Mr. W. R. Brooks once mentioned to me the case of an amateur who had sought in vain for comets during twenty years! On the other hand, a man may achieve a notable discovery by pure accident, like Mr. Holmes, of London, who, on 1892 November 6, having turned his telescope towards the great nebula in *Andromeda*, saw instead a bright naked-eye comet in the field!